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| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR       | ATTORNEY DOCKET NO.             | CONFIRMATION NO.            |
|---|-------------|----------------------------|---------------------------------|-----------------------------|
| 10/816,781  | 04/02/2004  | Sirikiat L. Ariyavisitakul | TI-36888AA                      | 9966                        |
| 23494 7590 07/24/2007<br>TEXAS INSTRUMENTS INCORPORATED<br>P O BOX 655474, M/S 3999<br>DALLAS, TX 75265 |             |                            | EXAMINER<br>SINGH, HIRDEPAL     |                             |
|   |             |                            | ART UNIT<br>2611                | PAPER NUMBER                |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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## Office Action Summary

Application No.

10/816,781

Applicant(s)

ARIYAVISITAKUL ET AL.

Examiner

Hirdepal Singh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 02 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-39 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 4/2/04 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

This action is in response to the filing date of April 02, 2004. Claims 1-39 are pending and have been considered below.

### ***Claim Objections***

1. Claims 5, and 24 are objected to because of the following informalities: Claims 5 and 24 has a limitation "computing a frequency-dependent SNIR from..." Whenever an acronym is used in a claim for the first time, it needs to be described in the plain text.

Appropriate correction is required.

### ***Double Patenting***

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to

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be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

3. Claims 1 and 20 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 22 and 50 of copending Application No. 10/454,421. Although the conflicting claims are not identical, they are not patentably distinct from each other because Claims 22 and 50 of the Application No. 10/454,421 claims all of the limitations set forth in the instant claims.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dent (US Patent no. 6,996,380) in view of Zangi et al. (US Pub. no. 2002/0176492).

**Regarding Claims 1 and 20:**

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Dent discloses prefilters in a receiver having at least two input branches (Col. 9, lines 52-61, Col. 11, lines 3-10), each branch-specific signal containing data from a target transmitter (col.2, lines 52-62) and possibly also interference (col. 2, lines 56-64), the method comprising:

- determining a frequency response of a conditioned channel that suppresses the interference (col.2, lines 52-64), wherein the frequency response is determined without reference to the branch-specific prefilters (Col. 18, lines 17-22, Col. 4, lines 11-21, Col. 14, lines 4- 17, lines 37-56, Col. 15, lines 41-56, Col. 17, lines 5-17); and
- computing frequency responses of the branch-specific prefilters from the frequency response of the conditioned channel(Col. 16, lines 13-57, particularly lines 13-20 & lines 39-45, Col. 14, lines 30-62, Col. 13, lines 56-67, Col. 3, lines 11-32, Col. 27, lines 15-18, Col. 32, lines i 0-18, See Parts 30A, 30B, 30N of Figure 2, Col. 27, lines 35-41, Col. 28, lines 9- 16, Col. 29, lines 23-29, Col. 32, lines 19-36).

Dent discloses all of the subject matter as explained above, except for explicitly teaching the input branches receiving branch-specific signals transmitted across communications channels.

However, Zangi, in same field of endeavor, teaches the input branches receiving branch-specific signals transmitted across communications channels (Figure 7, Sections 0016, 0047 - 0050).

Therefore, it would have been obvious to one of ordinary skill in the art at

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the time of invention to modify the system of Dent receiving branch-specific signals transmitted across communications channels of Zangi for the purpose of minimizing interference by using the branch specific prefilters.

**Regarding Claims 2 and 21:**

Dent disclose all of the subject matter as described above, and further discloses determining the frequency response of the conditioned channel, assuming lengths of the branch-specific prefilters are infinite (30A, 30B, 30N in Figure 2, Col. 3, lines 54- 67, Col. 4, lines 1-10, Col. 27, lines 15-18, Col. 32, lines 10-18, Col. 16, lines 13-20, and lines 39-45, where the prefilters 30 are Infinite impulse Response (IIR) filters).

**Regarding Claims 3 and 22:**

Dent discloses all of the subject matter as described above, and further discloses determining an impulse response of the conditioned channel without reference to the branch-specific prefilters (Col. 18, lines 17-22, Col. 4, lines 11-21, Col. 14, lines 4-17, lines 37-56, Col. 15, lines 41-56, Col. 17, lines 5-17), and transforming the impulse response of the conditioned channel to obtain the frequency response of the conditioned channel (Col. 15, lines 41-56).

**Regarding Claims 4 and 23:**

Dent discloses all of the subject matter as described above, and further discloses determining the conditioned channel as a linear predictive filter of a residual error

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between, an original signal before transmission across the communications channels (Col. 12, lines 53-59, Col. 18, lines 1- 6, Col. 21, lines 8-67, Col. 27, lines 10-24, Col. 29, lines 45-53, Col. 12, lines 5-11, Col. 8, lines 48-50), and a composite signal that combines the branch-specific received signals after transmission across the communications channels as filtered by a branch-specific equalizer, wherein the branch-specific equalizers collectively comprise an optimum space-time linear equalizer (Col. 9, lines 26-43, Col. 11, lines 11- 41, Col. 13, lines 1-3, Col. 14, lines 4-17, Col. 16, lines 39-45, Col. 17, lines 20-23, Col. 20, lines 1-28, Col. 23, lines 50-64, Col. 31, lines 20-25, Col. 34, lines 28-34).

**Regarding Claims 5 and 24:**

Dent discloses all of the subject matter as described above, and further discloses a module for determining frequency responses of the communications channels from the transmitters to the input branches (Col. 18, lines 17-22, Col. 4, lines 11-21, Col. 14, lines 4-17, lines 37-56, Col. 15, lines 41-56, Col. 17, lines 5-17); a first computational module for computing a frequency-dependent SNIR from the frequency responses of the communications channels (Col. 16, lines 30- 38, Col. 14, lines 4-17, Col. 13, lines 43-55); an inverse FFT for inverse transforming a function of the frequency-dependent SNR to obtain an autocorrelation function (Col. 14, lines 37-56, particularly lines 50- 55, Col. 16, lines 1-12, Col. 15, lines 41-56, Col. 34, lines 41-52, Col. 36, lines 46-51, Col. 3, lines 44-52, Col. 4, lines 2-10, Col. 7, lines 38-67, Col. 8, lines 1-31, Col. 9, lines 15-21 );

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a second computational module for computing an impulse response of the conditioned channel from the autocorrelation function (Col. 34, lines 41-52, Col. 3, lines 54-67, Col. 4, lines 1-10, Col. 8, lines 32-67, Col. 9, lines 1-10, lines 35-51, Col. 10, lines 51-56, Col. 15, lines 41-56, Col. 16, lines 39-45, Col. 23, lines 56-60); and

a second FFT for transforming the impulse response of the conditioned channel to obtain the frequency response of the conditioned channel (Col. 15, lines 41-56, Col. 8, lines 32-67, Col. 9, lines 1-10, lines 35-51, Col. 10, lines 51-56, Col. 16, lines 39-45, Col. 23, lines 56-60).

**Regarding Claims 6 and 25:**

Dent discloses all of the subject matter as described above, and further discloses the first computational module comprises:

a calculation module for calculating a noise-plus-interference correlation matrix that estimates correlation of interference plus noise (col. 3, lines 32-42, col. 4, lines 11-16, col. 27, lines 41-45, col. 28, lines 45-55, col. 29, lines 45-52); and

a computational module for computing the frequency-dependent SNIR from the noise-plus-interference correlation matrix and the frequency responses of the communications channels from the target transmitter to the input branches (col. 14, lines 40-48, col. 18, lines 17-25).

**Regarding Claims 7 and 26:**



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Dent discloses all of the subject matter as described above, and further discloses the second module computes the frequency responses of the branch-specific prefilters from the frequency response of the conditioned channel and the frequency responses of the communications channels in order to optimize a preselected performance metric (Col. 13, lines 4-14, Col. 17, lines 53-58, Col. 18, lines 7-16, Col.14, lines 37-62, Col. 18, lines 17-40).

**Regarding Claims 8 and 27:**

Dent discloses all of the subject matter as described above, and further discloses second module comprises a calculation module for calculating a noise-plus-interference correlation matrix that estimates correlation of interference plus noise (col. 17, lines 1-15, col. 3, lines 32-42, col. 4, lines 11-16, col. 27, lines 41-45, col. 28, lines 45-55, col. 29, lines 45-52), and a computational module for computing the frequency responses of the branch-specific prefilters from the noise-plus-interference correlation matrix, the frequency response of the conditioned channel and the frequency responses of the communications channels from the target transmitter to the input branches (col. 14, lines 40-48, col. 18, lines 17-25).

**Regarding Claims 9 and 28:**

Dent discloses all of the subject matter as described above, and further discloses

the first module determines the frequency response of the conditioned channel in a non-iterative manner (Col. 18, lines 17-29).

**Regarding Claims 10 and 29:**

Dent discloses all of the subject matter as described above, and further discloses a delay spread of the conditioned channel is one symbol duration (Col. 33, lines 48-56, Col. 36, lines 8-12, lines 34-37).

**Regarding Claims 11 and 30:**

Dent discloses all of the subject matter as described above, and further discloses the conditioned channel has a delay spread that is shorter than a delay spread of the effective communications channels from the target transmitter to the input branches (Col. 6, lines 1-15, lines 47-60).

**Regarding Claims 12 and 31:**

Dent discloses all of the subject matter as described above, and further discloses a sequence estimator coupled to the prefilter modules for combining the prefiltered, branch-specific signals to generate a composite, prefiltered signal; and further for processing the composite, prefiltered signal to estimate the data from the target transmitter (Col. 34, lines 28-34, Col. 10, lines 40-56, Col. 27, lines 35-44, Col. 28, lines 45-56, Col. 29, lines 13-22).

**Regarding Claims 13 and 32:**

Dent discloses all of the subject matter as described above, and further discloses the sequence estimator comprises a maximum likelihood sequence estimator (Col. 34, lines 28-34).

**Regarding Claims 14 and 33:**

Dent discloses all of the subject matter as described above, and further discloses the sequence estimator determines a confidence level of the estimate of the data (Col. 34, lines 28-34, Col. 10, lines 40-56, Col. 27, lines 35-44, Col. 28, lines 45-56, Col. 29, lines 13-22, Col. 9, lines 26-43, Col. 11, lines 11-41, Col. 13, lines 1-3, Col. 14, lines 4-17, Col. 16, lines 39-45, Col. 17, lines 20-23, Col. 20, lines 1-28, Col. 23, lines 50-64, Col. 31, lines 20-25, Col. 34, lines 28-34).

**Regarding Claims 15 and 34:**

Dent discloses all of the subject matter as described above, and further discloses a decoder coupled to the sequence estimator for decoding the estimate of the data, based in part on the confidence level of the estimate (Col. 9, lines 26-42, Col. 26, lines 38-47).

**Regarding Claims 16 and 35:**

Dent discloses all of the subject matter as described above, and further discloses an inverse FFT for inverse transforming the frequency responses of the branch-specific

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prefilters to obtain branch-specific tap Weights for impulse responses of the prefilters (Col. 14, lines 37- 56, particularly lines 50-55, Col. 16, lines 1-12, Col. 15, lines 41-56, Col. 34, lines 41-52, Col. 36, lines 46-51, Col. 3, lines 44-52, Col. 4, lines 2-10, Col. 7, lines 38-67, Col. 8, lines 1-31, Col. 9, lines 15-21, Abstract, lines 1-17, Col. 31, lines 26-31, lines 64-67, Col. 32, lines 1-36, lines 53-63, Col. 33, lines 1-15, Col. 34, lines 28-34), wherein the prefilter modules are coupled to receive the tap weights from the inverse FFT (Abstract, lines 1-17, Col. 31, lines 26-31, lines 64-67, Col. 32, lines 1-36, lines 53-63, Col. 33, lines 1-15, Col. 34, lines 28-34, See Part 112 of Figure 11).

**Regarding Claims 17, and 37:**

Dent discloses all of the subject matter as described above, and further discloses the data is transmitted in packets across the communications channels (Col. 5, lines 22-25).

**Regarding Claims 18, and 38:**

Dent discloses all of the subject matter as described above, and further discloses the communications channels are wireless (Col. 1, lines 57-63, Col. 3, lines 11-21, Col. 5, lines 10-37).

**Regarding Claim 19:**

Dent discloses all of the subject matter as described above, and further discloses

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the interference is generated by transmitters that are located in geographically separated cells from the target transmitter but use a same radio frequency as the target transmitter (col. 1, lines 56-64).

**Regarding Claim 36:**

Dent discloses all of the subject matter as described above, and further discloses a front-end with at least two input branches. Dent teaches a front-end with at least two input branches (Col. 9, lines 52-61, Col. 11, lines 3-10, the information from mobile terminals 16A-C are input to numerical processor 20).

**Regarding Claim 39:**

Dent discloses all of the subject matter as described above, except for explicitly teaching the training module and the prefilter module are implemented as circuitry on a single integrated circuit.

However, Zangi, in the same field of endeavor, discloses a receiver wherein the training module and the prefilter module are implemented as circuitry on a single integrated circuit (paragraph 0051).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to implement the training and prefilter modules of the receiver as a single integrated circuit (IC) as taught by Zangi in order to save the device space by placing whole circuitry on the same chip.

**Conclusion**

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Pare, Jr. et al. (US Patent no. 6,834,109) discloses system and method for compensating interferences in communication systems using training prefilters.

b. Greenstein et al. (US Patent no. 6,131,016) discloses system and method multiple channels for wireless communication.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hirdepal Singh whose telephone number is 571-270-1688. The examiner can normally be reached on Mon-Fri (Alternate Friday Off) 8:00AM-5:00PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shuwang Liu can be reached on 571-272-3036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

HS  
July 18, 2007

Shuwang Liu  
SPE - 2611



**SHUWANG LIU**  
**SUPERVISORY PATENT EXAMINER**